



# Technical Session III

## Indian Data Centers for the 21<sup>st</sup> Century

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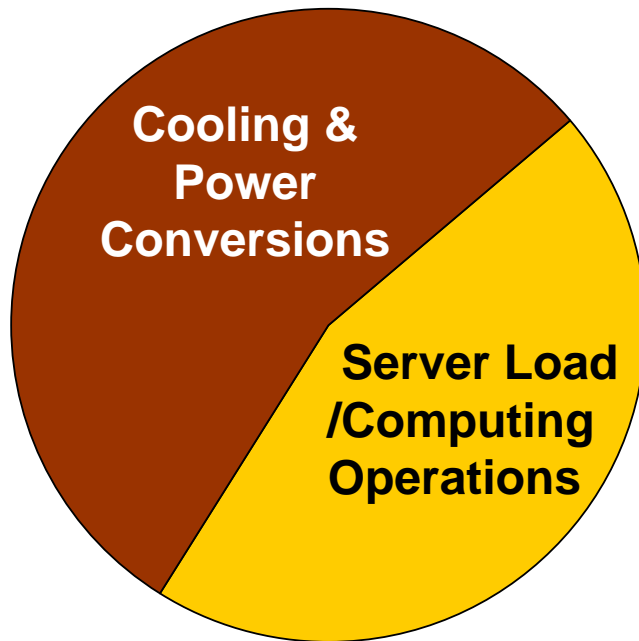




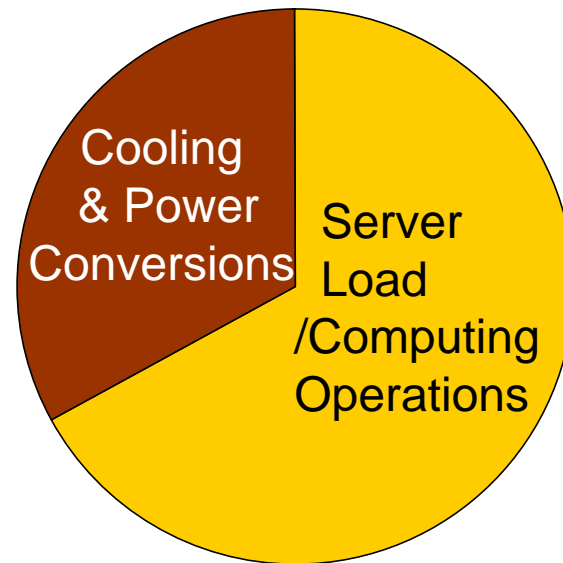
## Topics:

- Summary of Workshop
- Resources

# IT Equipment Efficiency, Data Center Cooling and Power Conversion Performance Varies



**Typical Practice**



**Better Practice**



# Summary of Opportunities for Energy Efficiency:

- IT equipment optimization
- Air management
- Right-sizing
- Central plant optimization
- Efficient air handling
- Free cooling
- Humidity control
- Power chain incl. UPSs and power supplies
- On-site generation
- Liquid cooling
- Design and M&O processes

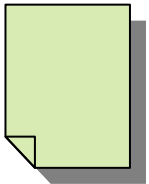
# Resources:



# Web-based Resource:

<http://hightech.lbl.gov/datacenters.html>

*Good starting point for those seeking efficiency measures*



**Best Practices**



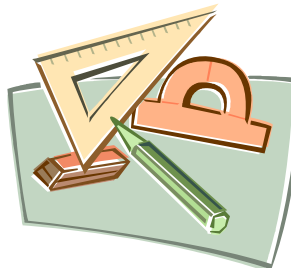
**Self-benchmarking Guide**



**Benchmark data**



**Case Studies**



**Design Guidance**



**Other Reports  
(demonstrations)**

# Design Guidance is Summarized in a Web Based Training Resource:

**Data Center Energy Management - Mozilla Firefox**

File Edit View Go Bookmarks Tools Help

http://hightech.lbl.gov/dctraining/TOP.html

mozilla.org Latest Builds

Home >

## DATA CENTER ENERGY MANAGEMENT

About Benchmarking Best Practices Checklist Design Intent Documentation Economics Non-energy Benefits Case Studies Tools Emerging Technologies

- This website will give you the tools and information to capture cost-effective savings opportunities to the design of new data centers or to retrofitting existing ones.
- Data center energy costs can be 100-times higher than those for typical buildings.
- Inefficiencies can hurt the bottom line, erode competitiveness, and reduce uptime.

**Get Started:**  
Enter your annual energy cost  
 \$/yr  
and data center size  
 sq ft

ft<sup>2</sup>/yr

\$75 High

\$5 Low

Range of Energy Costs in Real Data Centers

For public sector and private sector users.

High-Tech Research ■ Applications Team ■ Environmental Energy Technologies Division ■ Berkeley Lab

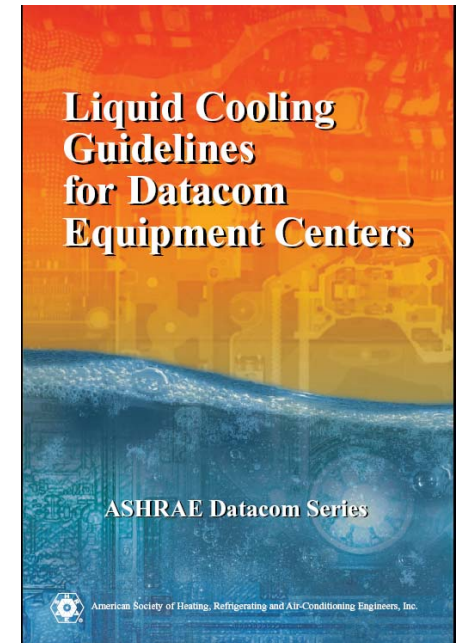
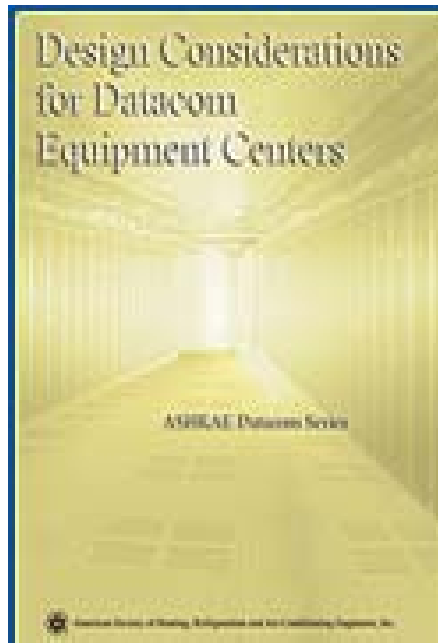
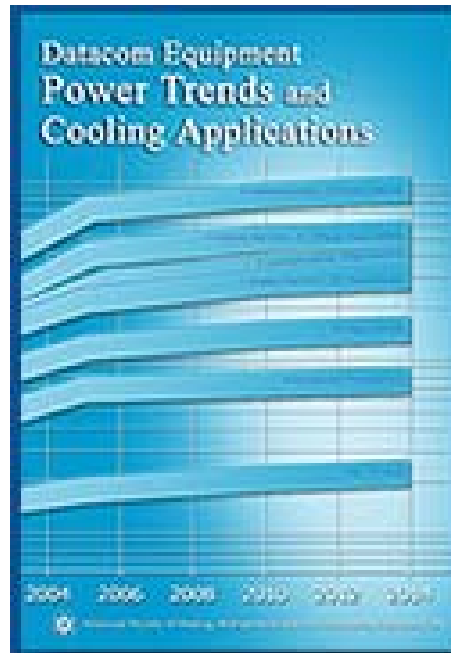
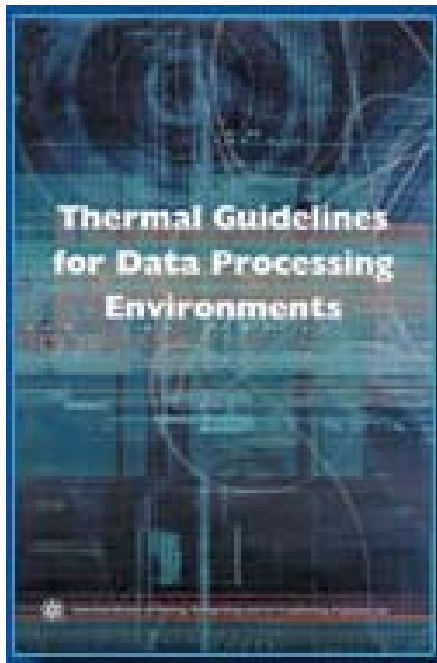
LAWRENCE  
BERKELEY  
NATIONAL  
LABORATORY

Presentations  
Chart Room  
Resources  
Exercises  
Credits

<http://hightech.lbl.gov/dctraining/TOP.html>

# ASHRAE Resources


Four books published—  
more in preparation



ASHRAE, Thermal Guidelines for Data Processing Environments, 2004, Datacom Equipment Power Trends and Cooling Applications, 2005, Design Considerations for Datacom Equipment Centers, 2005, Liquid Cooling Guidelines for Datacom Equipment Centers, 2006, © American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., [www.ashrae.org](http://www.ashrae.org)

Order from <http://tc99.ashraetcs.org/>



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- ASHRAE (<http://www.ashrae.org>)
    - Technical Committee (TC) 9.9 Mission Critical Facilities  
<http://tc99.ashraetcs.org/>
    - Design Considerations for Datacom Equipment Centers
    - Datacom Equipment Power Trends and Cooling Applications
    - Thermal Guidelines for Data Processing Environments
    - Additional Guidelines in Development
      - TCO and Energy Efficiency
      - High Density Data Centers
      - Liquid Cooling
      - Filtration
      - Structural



# Other Resources

- PG&E CoolTools™ Chilled Water Plant Design Guide ([http://taylor-engineering.com/publications/design\\_guides.shtml](http://taylor-engineering.com/publications/design_guides.shtml))
- LBNL High Performance Datacenters, A Design Guidelines Sourcebook ([http://hightech.lbl.gov/documents/DATA\\_CENTERS/06\\_DataCenters-PGE.pdf](http://hightech.lbl.gov/documents/DATA_CENTERS/06_DataCenters-PGE.pdf))
- Uptime Institute (<http://www.upsite.com/TUIpages/tuihome.html>)
- Green Grid (<http://www.thegreengrid.org/home>)
- DOE Website: Sign up to stay up to date on new developments ([www.eere.energy.gov/datacenters](http://www.eere.energy.gov/datacenters))
- EPA/Energy Star ([http://www.energystar.gov/index.cfm?c=prod\\_development.server\\_efficiency](http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency))

# Sponsors and Stakeholders

- Sponsors:

- California Energy Commission (CEC)

<http://www.energy.ca.gov/pier/>

- U.S. Department of Energy (DOE)

[http://www1.eere.energy.gov/industry/saveenergynow/partnering\\_data\\_centers.html](http://www1.eere.energy.gov/industry/saveenergynow/partnering_data_centers.html)

- U.S. Environmental Protection Agency

<http://www.energystar.gov/datacenters>

- Pacific Gas and Electric Company (PG&E)

[http://www.pge.com/docs/pdfs/biz/rebates/hightech/06\\_DataCenters-PGE.pdf](http://www.pge.com/docs/pdfs/biz/rebates/hightech/06_DataCenters-PGE.pdf)

- Stakeholders:

- Industry Organizations

e.g., Green Grid, ASHRAE, AFCOM, 7x24, SVLG

- Equipment suppliers

- Research organizations

- Consultants



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